

# PATENT ABSTRACTS OF JAPAN

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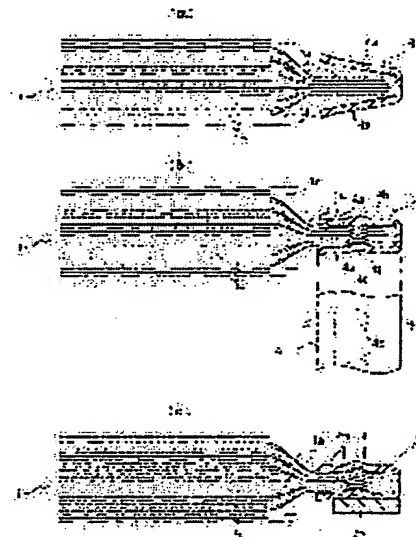
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## (54) BATTERY

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a battery surely connecting thin metal foils and a thick connecting plate part 2b by clamping and calking the metal foils such as positive electrodes 1a and negative electrodes 1b of power generating elements 1 between a clamp plate 4 and connecting the clamp plate 4 to the connecting plate part 2b of a current collecting/connecting body 2 by welding.

**SOLUTION:** The plurality of metal foils of the positive electrodes 1a and the negative electrodes 1b of the power generating elements 1 to be a power generating base are stacked on one another and then clamped and calked between the plate pieces 4a and 4b of the clamp plate 4 composed of a metal plate. The clamp plate 4 is connected and fixed to the connecting plate part 2b of the current collecting/connecting body 2 connected to the terminal 3 by welding.



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[Claim(s)]

[Claim 1]

The cell characterized by connection immobilization of this pinching plate being carried out by welding at the current collection object which was put between the pieces of a plate of the pinching plate with which the metallic foil used as the current collection base material of the electrode overflowing from the edge of a generation-of-electrical-energy element suits in two or more [-fold ], and consists of a metal plate, and was connected to the terminal with caulking \*\*\*\*.

[Claim 2]

What suited in two or more [-fold / of the metallic foil used as the current collection base material of the electrode overflowing from the edge of a generation-of-electrical-energy element ] with some current collection objects connected to the terminal it consists of a metal plate and puts between the pieces of a plate of the pinching plate which formed two or more projections in the medial surface of the piece of a plate of the side which will contact this metallic foil directly at least -- having -- the cell characterized by connection immobilization of this pinching plate being carried out by welding at some current collection objects closed and pinched.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the cell which connected the metallic foil used as the current collection base material of the electrode of a generation-of-electrical-energy element to the terminal through the current collection object.

[0002]

[Description of the Prior Art]

The connection structure of the conventional generation-of-electrical-energy element 1 and the current collection object 2 in a large-sized nonaqueous electrolyte rechargeable battery is shown in drawing 3 . This nonaqueous electrolyte rechargeable battery puts in order and carries out parallel connection of the two generation-of-electrical-energy elements 1 of an ellipse cartridge. Each generation-of-electrical-energy element 1 winds positive-electrode 1a and negative-electrode 1b around an ellipse cartridge through separator 1c, positive-electrode 1a makes the front face of band-like aluminium foil support positive active material, and negative-electrode 1b makes the front face of band-like copper foil support a negative-electrode active material. However, such positive-electrode 1a and negative-electrode 1b prepare the non-coating section which does not apply an active material in side edge section of band-like one of the two, respectively, and he is trying for aluminium foil and copper foil to expose them in this non-coating section. And only the aluminium foil of the side edge section of positive-electrode 1a protrudes into the end face [ on the other hand / (graphic display lower right) ] of an ellipse cartridge, and he is trying only for the copper foil of the side edge section of negative-electrode 1b to protrude such positive-electrode 1a and negative-electrode 1b into the end face of a flash and another side (graphic display upper left) by shifting to an opposite direction mutually in accordance with a winding shaft in the case of winding of the generation-of-electrical-energy element 1.

[0003]

The two above-mentioned generation-of-electrical-energy elements 1 and 1 are put in order every width so that the flat side faces of an ellipse cartridge may stand straight and overlap. And the current collection objects 2 and 2 are arranged, respectively to the both ends of these two generation-of-electrical-energy elements 1 and 1. The metal plate of sufficient thickness is used so that current capacity with the respectively big current collection objects 2 and 2 may be obtained. And the current collection object 2 which consists of an aluminum alloy plate is arranged, and the current collection object 2 which consists of a copper alloy plate is arranged at the end-face side which the

aluminium foil of positive-electrode 1a of the generation-of-electrical-energy element 1 protrudes at the end-face side which the copper foil of negative-electrode 1b protrudes. Each current collection object 2 consists of body 2a arranged mostly at the horizontal of trapezoidal shape, and four long and slender connection Itabe 2bs which turned caudad, bent from the base part of the trapezoidal shape of this body, and protruded in the shape of a ctenidium. And the bodies 2a and 2a of these current collection objects 2 and 2 are arranged above the edge of the generation-of-electrical-energy elements 1 and 1, and are connected to the soffit section of the terminals 3 and 3 of the forward negative electrode of a nonaqueous electrolyte rechargeable battery, respectively. The terminals 3 and 3 of a forward negative electrode are the connection material for connecting positive-electrode 1a and negative-electrode 1b of the generation-of-electrical-energy element 1 to an external circuit, and project in the exterior of a nonaqueous electrolyte rechargeable battery by carrying out insulating closure and penetrating the cover plate which is not illustrated.

[0004]

In the end-face side which the aluminium foil of positive-electrode 1a of each above-mentioned generation-of-electrical-energy element 1 protrudes, while dividing the lap of the bay of this aluminium foil into the graphic display upper and lower sides first and making each near connection Itabe 2b meet as shown in drawing 4, such connection Itabe 2bs and the aluminium foil of positive-electrode 1a are pinched with the pinching plate 4. The pinching plate 4 bends the aluminum alloy plate of the shape of a strip of paper thinner than the current collection object 2 so that the cross section which met the shorter side may serve as U typeface, and it makes connection Itabe 2b and the aluminium foil of positive-electrode 1a pinch among these bent pieces 4a and 4a of both plates. And connection immobilization of connection Itabe 2b and the aluminium foil of positive-electrode 1a is carried out by performing spot welding from the both sides of the pieces 4a and 4a of a plate of this pinching plate 4. Under the present circumstances, much projections are prepared in the field of the side which touches connection Itabe 2b with aluminium foil beforehand, and joining with aluminium foil can also be made into a positive thing by centralizing the energy of spot welding on these projections. Thus, when connection immobilization of connection Itabe 2b and aluminium foil which were pinched by the pinching plate 4 is carried out by spot welding, the positive electrodes 1a and 1a of the generation-of-electrical-energy elements 1 and 1 will be connected to the terminal 3 by the side of a positive electrode through the current collection object 2. Moreover, like the case by the side of a positive electrode, the copper foil of connection Itabe 2b and negative-electrode 1b is pinched by

the pinching plate 4, and connection immobilization also of the end-face side which the copper foil of negative-electrode 1b of each generation-of-electrical-energy element 1 protrudes is carried out by spot welding. However, a copper alloy plate is used for the pinching plate 4 by the side of this negative electrode. And the negative electrodes 1b and 1b of the generation-of-electrical-energy elements 1 and 1 will also be connected to the terminal 3 by the side of a negative electrode through the current collection object 2 by this.

[0005]

[Problem(s) to be Solved by the Invention]

However, since the aluminium foil of positive-electrode 1a of the generation-of-electrical-energy element 1 and the copper foil of negative-electrode 1b are very thin metallic foils, when joining of this tends to be carried out by spot welding, they have a possibility that a metallic foil may melt and disperse, by having added not much big energy. However, since a thick metal plate is used in order that connection Itabe 2b of the current collection object 2 may obtain sufficient current capacity, in order to carry out joining of this connection Itabe 2b by spot welding, energy big enough is needed. For this reason, after pinching the whole conventionally with the pinching plate 4 which consists of a metal plate of the middle board thickness of connection Itabe 2b and a metallic foil as mentioned above, it was made to perform spot welding, but also in this case, when energy of spot welding was enlarged too much, a metallic foil will carry out fusing scattering, and since joining with connection Itabe 2b became less enough when this energy is small, the problem that it became difficult to perform a sound weld had occurred.

[0006]

this invention is made in order to cope with this situation -- having -- the metallic foil of the plate of a generation-of-electrical-energy element -- a pinching plate -- inserting -- while closing, it aims at offering the cell which can connect certainly a thin metallic foil and a thick current collection object by connecting this pinching plate to a current collection object by welding.

[0007]

[Means for Solving the Problem]

The cell of claim 1 is characterized by connection immobilization of this pinching plate being carried out by welding at the current collection object which was put between the pieces of a plate of the pinching plate with which the metallic foil used as the current collection base material of the electrode overflowing from the edge of a generation-of-electrical-energy element suits in two or more [-fold ], and consists of a

metal plate, and was connected to the terminal with caulking \*\*\*\*.

[0008]

Since according to invention of claim 1 a thin metallic foil is inserted into the piece of a plate of the pinching plate which consists of a metal plate of moderate board thickness and it is closed whether it is mechanical, positive connection immobilization can be performed easily. Moreover, since this pinching plate consists of a metal plate thicker enough than a metallic foil, positive connection immobilization by thick current collection object and welding can be performed easily. Therefore, connection immobilization of the thin metallic foil used as the current collection base material of the electrode of a generation of electrical energy element can be carried out now easily for the current collection object which consists of a thick metal plate etc., and certainly.

[0009]

In addition, by carrying out bending of the metal plate of one sheet, each pinching plate forms the piece of a plate in both sides, and it may be made to put a metallic foil among these pieces of a plate, and the piece of two plates is arranged face to face, and it can put a metallic foil between the pieces of a plate which these became independent. this pinching plate -- a metallic foil -- putting -- since the bundle of the edge of a metallic foil with troublesome handling can be summarized with a pinching plate if it is made to perform welding with a current collection object after closing, welding operation becomes still easier. however, welding with a pinching plate and a current collection object -- previously -- carrying out -- this pinching plate -- a metallic foil -- putting -- it is also possible to be able to close and to perform welding and a bundle simultaneously.

[0010]

The above-mentioned pinching plate should close the metallic foil put between the pieces of a plate of these both sides by making plate one side of another side carry out projection deformation of a part of one piece of a plate. If it does in this way, since the metallic foil which put the metallic foil between the pieces of a plate of a pinching plate, and it made carry out projection deformation of a part of one piece of a plate at the other side, and it not only performs pressure from both sides, but was put among these pieces of a plate will be closed For example, the need that the irregularity for a caulking etc. is beforehand prepared in the piece of both plates is not only lost, but it can make connection immobilization by this caulking into a still more positive thing by making it eat into a metallic foil more closely, carrying out plastic deformation of a part of one piece of a plate.

[0011]

What suited in two or more [-fold / of the metallic foil used as the current collection base

material of the electrode overflowing from the edge of a generation-of-electrical-energy element ] the cell of claim 2 with some current collection objects connected to the terminal it consists of a metal plate and puts between the pieces of a plate of the pinching plate which formed two or more projections in the medial surface of the piece of a plate of the side which will contact this metallic foil directly at least -- having -- it is characterized by connection immobilization of this pinching plate being carried out by welding at some current collection objects closed and pinched.

[0012]

According to invention of claim 2, since a thin metallic foil is inserted into the piece of a plate of the pinching plate which consists of a metal plate of moderate board thickness, it is closed whether it is mechanical and two or more projections moreover formed in the medial surface of one [ at least ] piece of a plate eat into a metallic foil, positive connection immobilization can be performed easily. Moreover, since this pinching plate consists of a metal plate thicker enough than a metallic foil, positive connection immobilization by thick some current collection objects and welding can be performed easily. Furthermore, since it is pinched between the pieces of a plate of a pinching plate, by the caulking, both the parts and metallic foils of this current collection object are mutually close, and through the piece of a plate of a pinching plate, it will contact directly and they will be connected. Therefore, connection immobilization of the thin metallic foil used as the current collection base material of the electrode of a generation-of-electrical-energy element can be carried out now easily for the current collection object which consists of a thick metal plate etc., and certainly.

[0013]

in addition, welding with a pinching plate and some current collection objects -- between the piece of a plate of this pinching plate -- a metallic foil -- putting -- before closing -- it can also carry out -- a metallic foil -- putting -- it can also carry out in the condition of having closed. Although a metallic foil will also produce like before a possibility of melting and dispersing if it welds where a metallic foil is closed previously Since connection immobilization on some of pinching plates of this metallic foil or current collection objects will be performed by the caulking to the last and it will be closed especially whether the projection of the piece of a plate of a pinching plate is as trustworthy as a metallic foil Even if, as for the metallic foil in this welding part, connection may become instability by fusing scattering by limiting a welding part, except a welding part, connection immobilization can be certainly carried out by the caulking. If it welds to a pinching plate especially except the part in which the projection was formed, while, as for a metallic foil, it will be closed by projection

whether it is certain, some current collection objects can be certainly welded in the part which does not form the projection.

[0014]

[Embodiment of the Invention]

Hereafter, the operation gestalt of this invention is explained with reference to a drawing.

[0015]

The partial cross-sectional view drawing 1 - drawing 2 showing 1 operation gestalt of this invention, and showing the process which carries out connection immobilization of connection Itabe of a current collection object through a pinching plate in the aluminium foil [ in / in drawing 1 / the bay of one side of the generation-of-electrical-energy element of an ellipse cartridge ] of the positive electrode with which while overflowed into the end-face section, Drawing 2 is the partial cross-sectional view showing other processes which carry out connection immobilization of connection Itabe of a current collection object through a pinching plate in the aluminium foil of the positive electrode in the bay of one side of the generation-of-electrical-energy element of an ellipse cartridge which while protruded into the end-face section. In addition, the same number is appended to the configuration member which has the same function as the conventional example shown in drawing 3 - drawing 4 .

[0016]

This operation gestalt shows the connection structure of the generation-of-electrical-energy element 1 and the current collection object 2 in a large-sized nonaqueous electrolyte rechargeable battery like the conventional example. Although the configuration of the generation-of-electrical-energy element 1 or the current collection object 2 of the nonaqueous electrolyte rechargeable battery of this operation gestalt is the same as that of the conventional example, the connection structure of the pinching plate 4 differs from the conventional example. That is, the pinching plate 4 by the side of a positive electrode puts only the copper foil of negative-electrode 1b protruded from the other-end side of the generation-of-electrical-energy element 1 between piece of plate 4a, and 4a, although only the aluminium foil of piece of plate 4a and positive-electrode 1a protruded from the end face of the generation-of-electrical-energy element 1 among 4a is put and the graphic display is also omitting the pinching plate 4 by the side of a negative electrode, as shown in drawing 1 . In addition, drawing 1 and drawing 2 show only the partial cross section of the end-face section by the side of the positive electrode in the bay of one



side of the ellipse cartridge of one generation-of-electrical-energy element 1. Here, although, as for overlap and negative-electrode 1b, positive-electrode 1a and negative-electrode 1b are thoroughly covered with separator 1c through separator 1c, aluminium foil has protruded positive-electrode 1a outside separator 1c (graphic display right-hand side).

[0017]

The pinching plate 4 by the side of the above-mentioned positive electrode bends a strip-of-paper-like aluminum alloy plate so that the cross section which met the shorter side may serve as the shape of a typeface of KO. It is put among the pieces 4a and 4a of a plate of the both sides of the shape of a typeface of KO of this pinching plate 4, and the edges of the aluminium foil of positive-electrode 1a protruded from the end face of the generation-of-electrical-energy element 1 are caulking \*\*\*\*. That is, first, as shown in drawing 1 (a), the pinching plate 4 produces the pieces 4a and 4a of both plates, where a few is opened to Ha's typeface, and inserts what piled up the edge of the aluminium foil of positive-electrode 1a between this piece of both plates 4a, and 4a. Next, as shown in drawing 1 (b), the pieces 4a and 4a of both plates of the pinching plate 4 are pressed from both sides, and the bundle of the edge of aluminium foil is closed in an insert lump among these. Under the present circumstances, the pinching plate 4 is pressed with the metal mold which prepared two or more semi-sphere-like crevices mostly from the graphic display upper part corresponding to these heights while it is pressed with the metal mold which prepared two or more semi-sphere-like heights at spacing suitably mostly from the graphic display lower part. Thereby, variant parts 4b and 4b are formed in the pieces 4a and 4a of both plates of the pinching plate 4, and while variant-part 4b of piece of plate 4a by the side of a graphic display lower part carries out projection deformation towards the upper part at the shape of a semi-sphere mostly, the hollow to the semi-sphere-like upper part is mostly formed in variant-part 4b of piece of plate 4a by the side of the graphic display upper part. Therefore, since it is selectively incurvated up by not only being pressed strongly among the pieces 4a and 4a of both plates by the aluminium foil put between this pinching plate 4 but the variant parts 4b and 4b, while aluminium foil is strongly close by this bend, it is strongly close also in the medial surface of the pieces 4a and 4a of both plates, and connection immobilization is carried out certainly and firmly. Moreover, this pinching plate 4 can make pressure to aluminium foil a stronger thing, if it closes so that a path and the amount of projection may become large rather than variant-part 4b of the concave [ direction / of convex variant-part 4b of piece of plate 4a by the side of a graphic display lower part ] of piece of plate 4a by the side of the graphic display upper part. Furthermore, connection

immobilization can be made still firmer if it is made for this convex variant-part 4b to fit into concave variant-part 4b in the shape of a hook.

[0018]

above -- carrying out -- the aluminium foil of positive-electrode 1a -- putting -- as shown in drawing 1 (c), the closed pinching plate 4 is arranged so that the plate surface of connection Itabe 2b of the current collection object 2 by the side of a positive electrode may be met, and connection immobilization is carried out by ultrasonic welding. Under the present circumstances, since the pinching plate 4 is a metal plate with fully thick board thickness, it can impress big energy and it can be made it to carry out joining to connection Itabe 2b certainly. And since it is closed to the pinching plate 4 whether it is certain, the aluminium foil of positive-electrode 1a is hardly influenced of this ultrasonic welding. Thus, if connection immobilization of the pinching plate 4 is carried out at connection Itabe 2b, it will connect with the current collection object 2 certainly through this pinching plate 4, and positive-electrode 1a of the generation-of-electrical-energy element 1 will be connected also to the terminal 3 by the side of the positive electrode shown in drawing 3 by this.

[0019]

moreover, the edge of the copper foil of negative-electrode 1b which the pinching plate 4 by the side of a negative electrode bends a strip-of-paper-like copper alloy plate so that the cross section which met the shorter side may serve as the shape of a typeface of KO, and it began to see from the end face of the generation-of-electrical-energy element 1 like the case by the side of a positive electrode -- putting -- while closing, connection immobilization is carried out by ultrasonic welding at connection Itabe 2b of the current collection object 2 by the side of a negative electrode. And by this, through this pinching plate 4, connection immobilization will be carried out at the current collection object 2, and negative-electrode 1b of the generation-of-electrical-energy element 1 will also be connected to the terminal 3 by the side of a negative electrode.

[0020]

As for the above-mentioned pinching plate 4, it is more desirable than what was shown in the conventional example to use the thick metal plate of board thickness. although these middle comparatively thin metal plates needed to be used in order that the pinching plate 4 of the conventional example shown in drawing 3 and drawing 4 might carry out spot welding of the connection Itabe 2b which consists of a thin metallic foil and a thick metal plate -- the case of the pinching plate 4 of this operation gestalt -- above -- mechanical -- a metallic foil -- putting -- since it closes, the direction which uses a to some extent thick metal plate can maintain the connection immobilization by the

plastic deformation of a caulking more certainly. And since a charge and discharge current surely flows through this pinching plate 4 once unlike the case of the conventional example, the direction which used the thickest possible metal plate can contribute also to reduction of cell internal resistance.

[0021]

Since a such somewhat thick metal plate is used for the pinching plate 4 of this operation gestalt, it forms a concave beforehand inside the bending section of the shape of a typeface of cross-section KO, and it is made easy [ plate ] bending. Moreover, the bundle of a metallic foil is made easier to carry out bending of a little edge section of the pieces 4a and 4a of both plates of this pinching plate 4 so that it may spread outside, and to put. However, if there is no trouble in the assembly activity and caulking which put a metallic foil, bending of the pinching plate 4 may be carried out to a cross-section U typeface like the conventional example, and bending which extends the edge section of formation of a concave or the pieces 4a and 4a of a plate can also be omitted.

[0022]

according to the above-mentioned configuration, the aluminium foil of positive-electrode 1a which it began to see from the end face of the generation-of-electrical-energy element 1, and the copper foil of negative-electrode 1b are put among the pieces 4a and 4a of a plate of the pinching plate 4 which consists of a metal plate with board thickness thick to some extent -- having -- since it is closed and is moreover firmly close with variant parts 4b and 4b, positive connection immobilization can be performed easily. Moreover, since this pinching plate 4 consists of a metal plate with board thickness thick to some extent, welding can perform positive connection immobilization also to connection Itabe 2b of the current collection object 2 which consists of a thick metal plate easily. Therefore, according to this operation gestalt, connection immobilization of the thin aluminium foil used as positive-electrode 1a of the generation-of-electrical-energy element 1 and the current collection base material of negative-electrode 1b or the copper foil can be carried out easily for the current collection object 2 which consists of a thick metal plate, and certainly, and improvement in a cell property can be aimed at now.

[0023]

in addition -- the above-mentioned operation gestalt -- the pinching plate 4 -- a metallic foil -- putting -- although the case where semi-sphere-like variant-part 4b was mostly formed in the pieces 4a and 4a of both plates was shown when closing, you may make it form isosceles triangle-like variant-part 4b, as shown in drawing 2 (a) Variant-part 4b of the shape of this isosceles triangle is pushed by isosceles triangle-like projection from a graphic display lower part, pressing the pieces 4a and 4a of both plates of the pinching

plate 4 from both sides. He puts slitting of both the isosceles triangle-like hypotenuses into the pieces 4a and 4a of a plate, and is trying to make the graphic display upper part project by pushing on a graphic display upper part side more, so that top-most vertices are approached rather than the base of the shape of this isosceles triangle. Moreover, connection Itabe 2b of the current collection object 2 is welded to piece of plate 4a of the graphic display bottom to which variant-part 4b of the shape of this isosceles triangle becomes depressed, as shown in drawing 2 (b). Therefore, while variant-part 4b of the pieces 4a and 4a of both plates bends on an isosceles triangle-like base and cuts a part of metallic foil, this pinching plate 4 can perform certain and firm connection immobilization, when a top-most-vertices side eats away up. And a metallic foil becomes by such variant-part 4b from the pinching plate 4, it lengthens and be hard to blunder.

[0024]

moreover -- although the above-mentioned operation gestalt showed the case where the pinching plate 4 which bent the metal plate of one sheet and the pieces 4a and 4a of both plates were made to counter was used -- between the pieces 4a and 4a of both plates -- a metallic foil -- putting -- since what is necessary is just to be able to close, these pieces 4a and 4a of both plates are the metal plates which became independent, respectively, and may be unified by the caulking. Furthermore, although the above-mentioned operation gestalt showed the case where it put between two pinching plates 4 by dividing and laying the metallic foil protruded into each end face of the generation-of-electrical-energy element 1 on top of a two way type, the number of the pinching plates 4 to be used is arbitrary, may pile up these metallic foils collectively, may also put them between one pinching plate 4, and can be put between three or more pinching plates 4.

[0025]

moreover -- the above-mentioned operation gestalt -- the pieces 4a and 4a of both plates of the pinching plate 4 -- almost -- variant-part 4b of the shape of the shape of a semi-sphere, or an isosceles triangle -- preparing -- although the case where it closed was shown, the configuration of this variant-part 4b and the existence of slitting can also prepare irregularity long in the shape of a muscle in the longitudinal direction of piece of plate 4a arbitrarily. Furthermore, it is also possible by pressing strongly the pieces 4a and 4a of both plates of the pinching plate 4 from both sides to close a metallic foil, without preparing such variant-part 4b. However, in this case, in order to make a caulking into a positive thing, it is desirable to form irregularity in the pieces 4a and 4a of both plates of the pinching plate 4 beforehand.

[0026]

moreover -- the above-mentioned operation gestalt -- the pinching plate 4 -- a metallic foil -- putting -- although the case where welding with connection Itabe 2b was performed was shown after closing -- previously -- the pinching plate 4 and connection Itabe 2b -- welding -- this pinching plate 4 -- a metallic foil -- putting -- it is also possible to be able to close and to perform this welding and bundle simultaneously. Furthermore, although the above-mentioned operation gestalt showed the case where connection immobilization of the pinching plate 4 and the connection Itabe 2b was carried out by ultrasonic welding, other welding means, such as spot welding, and laser welding, TIG arc welding, can perform connection immobilization.

[0027]

Moreover, although the above-mentioned operation gestalt showed the case where it welded by making the outside surface of one piece of plate 4a of the pinching plate 4 meet connection Itabe 2b of the current collection object 2, while forming two or more projections in the inner surface of piece of plate 4a of another side, it can also weld by making the inner surface of piece of plate 4a of one of these meet connection Itabe 2b of the current collection object 2. That is, a metallic foil is put between the pinching plate 4 with connection Itabe 2b, and it may be made to carry out connection immobilization of a caulking and this connection Itabe 2b by welding at the pinching plate 4. If it does in this way, while it will be closed by the projection of piece of plate 4a whether a metallic foil and the pinching plate 4 are trustworthy, a metallic foil and connection Itabe 2b can be close with the caulking of the pinching plate 4, direct continuation can come to be carried out it is not only welded certainly, but, and this pinching plate 4 and connection Itabe 2b can also reduce the electric resistance of these connections.

[0028]

It is also possible also in the above-mentioned case, for welding and a bundle to perform whichever first and to perform these simultaneously. However, if it welds where a metallic foil is closed previously, the energy of welding will be added also not only between between the pinching plate 4 and connection Itabe 2bs but between this connection Itabe 2b and metallic foil, and a metallic foil will also produce like before a possibility of melting and dispersing. However, connection immobilization in the pinching plate 4 and connection Itabe 2b of a metallic foil is performed by the caulking to the last, and the projection of piece of plate 4a eats into a metallic foil, and especially, since it will be closed whether it is certain Even if, as for the metallic foil in this welding part, connection may become instability by fusing scattering by limiting spacing for a welding part to open beam two or more parts, except a welding part, connection immobilization of the metallic foil can be certainly carried out by the caulking. Under

the present circumstances, as for the pinching plate 4, it is desirable to avoid the part in which the projection of piece of plate 4a was formed, and to set up a welding part. If it does in this way, while connection immobilization of the metallic foil will be certainly carried out by the caulking in the part in which the projection was formed, connection immobilization of the connection Itabe 2b can be certainly carried out by welding in the welding part which does not form the projection.

[0029]

Moreover, although the above-mentioned operation gestalt showed the case where connection immobilization of the pinching plate 4 was carried out to connection Itabe 2b in which the current collection object 2 which consists of a metal plate bent from body 2a, and projected in the shape of a ctenidium, the configuration of this current collection object 2 is arbitrary, and what began to shave a metal plate, and other mere bars or metallic materials of a configuration, or was formed with the casting can also be used.

[0030]

Moreover, with the above-mentioned operation gestalt, although the generation-of-electrical-energy element 1 of an ellipse cartridge winding mold was explained, the configuration of this generation-of-electrical-energy element is arbitrary, and can be carried out also like the generation-of-electrical-energy element of a cylindrical shape winding mold, or the generation-of-electrical-energy element of a laminating mold. For example, what is necessary is just to use the pinching plate which curved along with the metallic foil comparatively protruded into a cylindrical shape, using the short pinching plate of die length in the case of the generation-of-electrical-energy element of a cylindrical shape winding mold. Furthermore, although the above-mentioned operation gestalt explained the nonaqueous electrolyte rechargeable battery, if it is the cell which connected the metallic foil used as the current collection base material of the electrode of a generation-of-electrical-energy element to the terminal through the current collection object, the class of this cell is arbitrary.

[0031]

[Effect of the Invention]

Since connection immobilization of the thin metallic foil used as the current collection base material of the electrode of a generation-of-electrical-energy element comes to be carried out easily for a thick current collection object, and certainly through the pinching plate which consists of a metal plate of moderate board thickness according to the cell of this invention so that clearly from the above explanation, while raising the workability like the assembler of a cell, quality can be stabilized, and improvement in

the cell engine performance can be aimed at.

[Brief Description of the Drawings]

[Drawing 1] It is the partial cross-sectional view showing 1 operation gestalt of this invention and showing the process which carries out connection immobilization of connection Itabe of a current collection object through a pinching plate in the aluminium foil of the positive electrode in the bay of one side of the generation-of-electrical-energy element of an ellipse cartridge which while protruded into the end-face section.

[Drawing 2] It is the partial cross-sectional view showing 1 operation gestalt of this invention and showing other processes which carry out connection immobilization of connection Itabe of a current collection object through a pinching plate in the aluminium foil of the positive electrode in the bay of one side of the generation-of-electrical-energy element of an ellipse cartridge which while protruded into the end-face section.

[Drawing 3] It is the perspective view in which showing the conventional example and showing the structure of connecting a terminal to the electrode of the generation-of-electrical-energy element of an ellipse cartridge winding mold through a current collection object.

[Drawing 4] It is the partial cross-sectional view showing the conventional example and showing the configuration which pinched with the pinching plate and carried out connection immobilization of connection Itabe of a current collection object in the aluminium foil of the positive electrode in the generation-of-electrical-energy element of an ellipse cartridge which while protruded into the end-face section.

[Description of Notations]

1 Generation-of-Electrical-Energy Element

1a Positive electrode

1b Negative electrode

2 Current Collection Object

2b Connection Itabe

3 Terminal

4 Pinching Plate

4a The piece of a plate

4b Variant part

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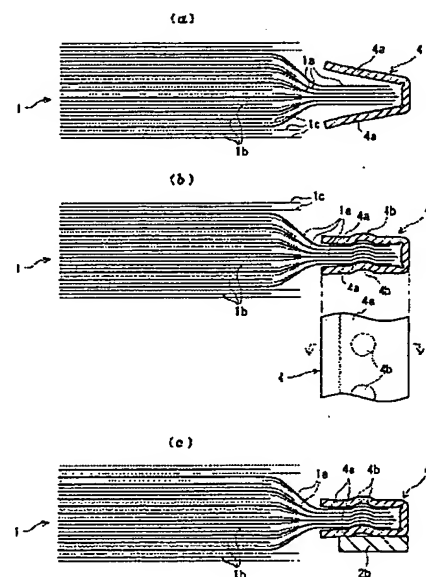
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(54) 【発明の名称】 電池

(57) 【要約】

【課題】 発電要素1の正極1aや負極1bの金属箔を挟持板4で挟んでかしめると共に、この挟持板4を集電接続体2の接続板部2bに溶接により接続することにより、薄い金属箔と厚い接続板部2bとを確実に接続することができる電池を提供する。

【解決手段】 発電要素1の正極1aや負極1bの集電基材となる金属箔が端部で複数重なり合って金属板からなる挟持板4の板片4a、4a間に挟み込まれかしめられると共に、端子3に接続された集電接続体2の接続板部2bにこの挟持板4が溶接により接続固定された構成とする。





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## 【特許請求の範囲】

## 【請求項1】

発電要素の端部からはみ出した電極の集電基材となる金属箔が複数重なり合っ

て金属板からなる挟持板の板片間に挟み込まれかしめられると共に、端子に接続された集電接続体にこの挟持板が溶接により接続固定されたことを特徴とする電池。

## 【請求項2】

発電要素の端部からはみ出した電極の集電基材となる金属箔の複数重なり合ったものが、端子に接続された集電接続体の一部と共に、金属板からなり、少なくともこの金属箔に直接当接することになる側の板片の内側面に複数の突起を形成した挟持板の板片間に挟み込まれてかしめられ、挟持された集電接続体の一部にこの挟持板が溶接により接続固定されたことを特徴とする電池。

## 【発明の詳細な説明】

## 【0001】

## 【発明の属する技術分野】

本発明は、発電要素の電極の集電基材となる金属箔を集電接続体を介して端子に接続した電池に関する。

## 【0002】

## 【従来の技術】

図3に、大型の非水電解質二次電池における従来の発電要素1と集電接続体2との接続構造を示す。この非水電解質二次電池は、2個の長円筒形の発電要素1を並べ並列接続したものである。各発電要素1は、正極1aと負極1bをセパレータ1cを介して長円筒形に巻回したものであり、正極1aは帯状のアルミニウム箔の表面に正極活物質を担持させ、負極1bは帯状の銅箔の表面に負極活物質を担持させたものである。ただし、これらの正極1aと負極1bは、それぞれ帯状の片方の側端部に活物質を塗布しない未塗工部を設けておき、この未塗工部でアルミニウム箔と銅箔が露出するようにしている。そして、これらの正極1aと負極1bは、発電要素1の巻回の際に、巻回軸に沿って互いに反対方向にずらすことにより、長円筒形的一方（図示右下）の端面には正極1aの側端部のアルミニウム箔のみがはみ出し、他方（図示左上）の端面には負極1bの側端部の銅箔のみがはみ出すようにしている。

## 【0003】

上記2個の発電要素1、1は、長円筒形の平坦な側面同士が直立して重なり合うように横置きに並べられる。そして、これら2個の発電要素1、1の両端部にそれぞれ集電接続体2、2が配置されている。集電接続体2、2は、それぞれ大きな電流容量が得られるように十分な厚さの金属板が使用される。そして、発電要素1の正極1aのアルミニウム箔がはみ出す端面側には、アルミニウム合金板からなる集電接続体2が配置され、負極1bの銅箔がはみ出す端面側には、銅合金板からなる集電接続体2が配置される。各集電接続体2は、ほぼ台形状の水

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平に配置された本体2aと、この本体の台形状の底辺部から下方に向けて折れ曲がって櫛歯状に突設された4本の細長い接続板部2bとからなる。そして、これらの集電接続体2、2の本体2a、2aは、発電要素1、1の端部の上方に配置されて、それぞれ非水電解質二次電池の正負極の端子3、3の下端部に接続されるようになっている。正負極の端子3、3は、発電要素1の正極1aと負極1bを外部の回路に接続するための接続部材であり、図示しない蓋板を絶縁封止されて貫通することにより、非水電解質二次電池の外部に突出するようになっている。

## 【0004】

上記各発電要素1の正極1aのアルミニウム箔がはみ出す端面側では、図4に示すように、まずこのアルミニウム箔の直線部の重なりを図示上下に分けて、それぞれの側の接続板部2bに沿わせると共に、これらの接続板部2bと正極1aのアルミニウム箔とを挟持板4で挟持する。挟持板4は、集電接続体2よりは薄い短冊状のアルミニウム合金板を短辺に沿った横断面がU字形となるように折り曲げたものであり、この折り曲げた両板片4a、4aの間に、接続板部2bと正極1aのアルミニウム箔とを挟持させる。そして、この挟持板4の板片4a、4aの両側からスポット溶接を行うことにより、接続板部2bと正極1aのアルミニウム箔とを接続固定する。この際、接続板部2bには予めアルミニウム箔と接する側の面に多数の突起を設けておき、スポット溶接のエネルギーをこれらの突起に集中させることによりアルミニウム箔との溶着を確実なものにすることもできる。このようにして挟持板4に挟持された接続板部2bとアルミニウム箔とがスポット溶接により接続固定されると、発電要素1、1の正極1a、1aが集電接続体2を介して正極側の端子3に接続されることになる。また、各発電要素1の負極1bの銅箔がはみ出す端面側でも、正極側の場合と同様に、接続板部2bと負極1bの銅箔とが挟持板4に挟持されてスポット溶接により接続固定される。ただし、この負極側の挟持板4には、銅合金板が用いられる。そして、これにより、発電要素1、1の負極1b、1bも、集電接続体2を介して負極側の端子3に接続されることになる。

## 【0005】

## 【発明が解決しようとする課題】

ところが、発電要素1の正極1aのアルミニウム箔や負極1bの銅箔は、極めて薄い金属箔であるため、これをスポット溶接により溶着させようとすると、あまり大きなエネルギーを加えたのでは金属箔が溶断し飛散するおそれがある。しかしながら、集電接続体2の接続板部2bは、十分な電流容量を得るため厚い金属板を用いるので、この接続板部2bをスポット溶接により溶着させるには、十分に大きなエネルギーが必要となる。このため

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の板厚の金属板からなる挟持板4で全体を挟持してからスポット溶接を行うようにしていたが、この場合にも、スポット溶接のエネルギーを大きくしすぎると金属箔が溶断飛散することになり、このエネルギーが小さい場合には接続板部2bとの溶着が十分でなくなるため、確実な溶接を行うことが困難になるという問題が発生していた。

【0006】

本発明は、かかる事情に対処するためになされたものであり、発電要素の極板の金属箔を挟持板で挟んでかしめると共に、この挟持板を集電接続体に溶接により接続することにより、薄い金属箔と厚い集電接続体とを確実に接続することができる電池を提供することを目的としている。

【0007】

【課題を解決するための手段】

請求項1の電池は、発電要素の端部からはみ出した電極の集電基材となる金属箔が複数重なり合っ金属板からなる挟持板の板片間に挟み込まれかしめられると共に、端子に接続された集電接続体にこの挟持板が溶接により接続固定されたことを特徴とする。

【0008】

請求項1の発明によれば、薄い金属箔は適度な板厚の金属板からなる挟持板の板片に挟まれて機械的にかしめられるので、容易に確実な接続固定を行うことができる。また、この挟持板は、金属箔よりも十分に厚い金属板からなるので、厚さのある集電接続体と溶接による確実な接続固定を容易に行うことができる。従って、発電要素の電極の集電基材となる薄い金属箔を厚い金属板等からなる集電接続体に容易かつ確実に接続固定することができるようになる。

【0009】

なお、各挟持板は、一枚の金属板を曲げ加工することにより両側に板片を形成し、これらの板片の間に金属箔を挟み込むようにしてもよいし、2枚の板片を向かい合わせに配置して、これら独立した板片の間に金属箔を挟み込むようにすることもできる。この挟持板は、金属箔を挟み込んでかしめた後に、集電接続体との溶接を行うようにすれば、取り扱いが厄介な金属箔の端部の束を挟持板によってまとめておくことができるので、溶接作業がさらに容易となる。しかしながら、挟持板と集電接続体との溶接を先に行い、この挟持板に金属箔を挟み込んでかしめるようにすることもでき、溶接とかしめを同時にすることも可能である。

【0010】

上記挟持板は、一方の板片の一部を他方の板片側に突出変形させることにより、これら双方の板片間に挟み込んだ金属箔をかしめたものとする。このようにすれば、挟持板の板片間に金属箔を挟み込んで両側から圧迫を行うだけでなく、一方の板片の一部を他方側に

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突出変形させて、これらの板片間に挟み込んだ金属箔をかしめるので、例えば両板片に予めかしめのための凹凸等を設けておくような必要がなくなるだけでなく、一方の板片の一部を塑性変形させながらより密接に金属箔に食い込ませることにより、このかしめによる接続固定をさらに確実なものにすることができる。

【0011】

請求項2の電池は、発電要素の端部からはみ出した電極の集電基材となる金属箔の複数重なり合ったものが、端子に接続された集電接続体の一部と共に、金属板からなり、少なくともこの金属箔に直接当接することになる側の板片の内側面に複数の突起を形成した挟持板の板片間に挟み込まれてかしめられ、挟持された集電接続体の一部にこの挟持板が溶接により接続固定されたことを特徴とする。

【0012】

請求項2の発明によれば、薄い金属箔は適度な板厚の金属板からなる挟持板の板片に挟まれて機械的にかしめられ、しかも、少なくとも一方の板片の内側面に形成された複数の突起が金属箔に食い込むので、容易に確実な接続固定を行うことができる。また、この挟持板は、金属箔よりも十分に厚い金属板からなるので、厚さのある集電接続体の一部と溶接による確実な接続固定を容易に行うことができる。さらに、この集電接続体の一部と金属箔は、共に挟持板の板片間に挟持されるので、かしめによって互いに密接し、挟持板の板片を介することなく直接接触し接続されることになる。従って、発電要素の電極の集電基材となる薄い金属箔を厚い金属板等からなる集電接続体に容易かつ確実に接続固定することができるようになる。

【0013】

なお、挟持板と集電接続体の一部との溶接は、この挟持板の板片間に金属箔を挟み込んでかしめる前に行うこともできるし、金属箔を挟み込んでかしめた状態で行うこともできる。先に金属箔をかしめた状態で溶接を行うと、従来のように金属箔が溶断して飛散するおそれもあるが、この金属箔の挟持板や集電接続体の一部への接続固定はあくまでかしめによって行われるものであり、特に挟持板の板片の突起が金属箔と確実にかしめられることになるので、溶接箇所を限定することにより、この溶接箇所での金属箔は溶断飛散により接続が不安定になることはあっても、溶接箇所以外ではかしめにより確実に接続固定されるようにすることができる。特に、挟持板に突起を形成した部分以外で溶接を行えば、金属箔は突起により確実にかしめられると共に、集電接続体の一部は突起を形成していない部分で確実に溶接されるようにすることができる。

【0014】

【発明の実施の形態】

以下、本発明の実施形態について図面を参照して説明す

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【0015】

図1～図2は本発明の一実施形態を示すものであって、図1は長円筒形の発電要素の片側の直線部における一方の端面部にはみ出した正極のアルミニウム箔に挟持板を介して集電接続体の接続板部を接続固定する工程を示す部分横断面図、図2は長円筒形の発電要素の片側の直線部における一方の端面部にはみ出した正極のアルミニウム箔に挟持板を介して集電接続体の接続板部を接続固定する他の工程を示す部分横断面図である。なお、図3～図4に示した従来例と同様の機能を有する構成部材には同じ番号を付記する。

【0016】

本実施形態は、従来例と同様に、大型の非水電解質二次電池における発電要素1と集電接続体2との接続構造を示す。本実施形態の非水電解質二次電池は、発電要素1や集電接続体2の構成は従来例と同じであるが、挟持板4の接続構造が従来例とは異なる。即ち、正極側の挟持板4は、図1に示すように、板片4a、4a間に発電要素1の端面からはみ出す正極1aのアルミニウム箔のみを挟み込み、負極側の挟持板4も、図示は省略しているが、板片4a、4a間に発電要素1の他方の端面からはみ出す負極1bの銅箔のみを挟み込むようになっている。なお、図1と図2では、1個の発電要素1の長円筒形の片側の直線部における正極側の端面部の部分横断面のみを示す。ここでは、正極1aと負極1bがセパレータ1cを介して重なり合い、負極1bはセパレータ1cに完全に覆われるが、正極1aはアルミニウム箔がセパレータ1cよりも外側（図示右側）にはみ出している。

【0017】

上記正極側の挟持板4は、短冊状のアルミニウム合金板を短辺に沿った横断面がコの字形状となるように折り曲げたものである。発電要素1の端面からはみ出した正極1aのアルミニウム箔の端部は、この挟持板4のコの字形状の両側の板片4a、4aの間に挟み込まれかしめられる。即ち、まず挟持板4は、図1(a)に示すように、両板片4a、4aをハの字形に少し開いた状態で作製し、正極1aのアルミニウム箔の端部を重ね合わせたものをこの両板片4a、4a間に挿入する。次に、図1(b)に示すように、挟持板4の両板片4a、4aを両側から押圧して、これらの間にアルミニウム箔の端部の束を挟み込みかしめる。この際、挟持板4は、図示下方からほぼ半球状の凸部を適宜間隔で複数設けた金型で押圧されると共に、図示上方からこの凸部に対応してほぼ半球状の凹部を複数設けた金型で押圧される。これにより、挟持板4の両板片4a、4aには変形部4b、4bが形成され、図示下方側の板片4aの変形部4bは、ほぼ半球状に上方に向けて突出変形すると共に、図示上方側の板片4aの変形部4bには、ほぼ半球状の上方への窪みが形成される。従って、この挟持板4に挟み込まれ

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たアルミニウム箔は、両板片4a、4aの間で強く圧迫されるだけでなく、変形部4b、4bによって部分的に上方に湾曲させられるので、この湾曲部でアルミニウム箔同士が強く密接されると共に、両板片4a、4aの内側面にも強く密接されて、確実かつ強固に接続固定される。また、この挟持板4は、図示下方側の板片4aの凸状の変形部4bの方が図示上方側の板片4aの凹状の変形部4bよりも径や突出量が大きくなるようにかしめれば、アルミニウム箔への圧迫をより強いものにすることができる。さらに、この凸状の変形部4bが凹状の変形部4bにホック状に嵌まり込むようにすれば、接続固定をより一層強固なものにすることができる。

【0018】

上記のようにして正極1aのアルミニウム箔を挟み込んでかしめた挟持板4は、図1(c)に示すように、正極側の集電接続体2の接続板部2bの板面に沿うように配置されて超音波溶接により接続固定される。この際、挟持板4は十分に板厚の厚い金属板であるため、大きなエネルギーを印加して確実に接続板部2bに溶着させることができるようになる。しかも、正極1aのアルミニウム箔は、挟持板4に確実にかしめられているので、この超音波溶接の影響をほとんど受けることがない。このようにして挟持板4が接続板部2bに接続固定されると、発電要素1の正極1aがこの挟持板4を介して集電接続体2に確実に接続されることになり、これによって図3に示した正極側の端子3にも接続される。

【0019】

また、負極側の挟持板4は、短冊状の銅合金板を短辺に沿った横断面がコの字形状となるように折り曲げたものであり、正極側の場合と同様に、発電要素1の端面からはみ出した負極1bの銅箔の端部を挟み込んでかしめると共に、負極側の集電接続体2の接続板部2bに超音波溶接により接続固定される。そして、これにより発電要素1の負極1bもこの挟持板4を介して集電接続体2に接続固定され、負極側の端子3に接続されることになる。

【0020】

上記挟持板4は、従来例で示したもののよりも板厚の厚い金属板を用いることが好ましい。図3及び図4に示した従来例の挟持板4は、薄い金属箔と厚い金属板からなる接続板部2bとをスポット溶接するために、これらの中間の比較的薄い金属板を用いる必要があったが、本実施形態の挟持板4の場合には、上記のように機械的に金属箔を挟み込んでかしめるので、ある程度厚い金属板を用いる方がかしめの塑性変形による接続固定をより確実に維持することができるようになる。しかも、従来例の場合と異なり、充放電電流が必ず一旦この挟持板4を通過して流れるので、できるだけ厚い金属板を用いた方が電池内部抵抗の低減にも貢献することができる。

【0021】

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本実施形態の挟持板4は、このように少し厚い金属板を用いるので、横断面コの字形の折り曲げ部の内側には予め凹溝を形成して曲げ加工が容易となるようにしている。また、この挟持板4の両板片4a、4aの端縁部は、少し外側に広がるように曲げ加工されていて、金属箔の束をより挟み込み易くしている。ただし、金属箔を挟み込む組み立て作業やかしめ加工に支障がないならば、挟持板4を従来例のように横断面U字形に曲げ加工してもよく、凹溝の形成や板片4a、4aの端縁部を広げる曲げ加工を省略することもできる。

## 【0022】

上記構成によれば、発電要素1の端面からはみ出した正極1aのアルミニウム箔や負極1bの銅箔は、ある程度板厚の厚い金属板からなる挟持板4の板片4a、4aの間に挟み込まれてかしめられ、しかも、変形部4b、4bによって強固に密接されるので、容易に確実な接続固定を行うことができる。また、この挟持板4は、ある程度板厚の厚い金属板からなるので、厚い金属板からなる集電接続体2の接続板部2bにも、容易に溶接により確実な接続固定を行うことができる。従って、本実施形態によれば、発電要素1の正極1aと負極1bの集電基材となる薄いアルミニウム箔や銅箔を厚い金属板からなる集電接続体2に容易かつ確実に接続固定することができ、電池特性の向上を図ることができるようになる。

## 【0023】

なお、上記実施形態では、挟持板4に金属箔を挟み込んでかしめる際に、両板片4a、4aにほぼ半球状の変形部4bを形成する場合を示したが、図2(a)に示すように、二等辺三角形形状の変形部4bを形成するようにしてもよい。この二等辺三角形形状の変形部4bは、挟持板4の両板片4a、4aを両側から押圧しながら図示下方から二等辺三角形形状の突起で押したものであり、この二等辺三角形形状の底辺よりも頂点に近付くほどより図示上方側に押すことにより、板片4a、4aに二等辺三角形形状の両斜辺の切り込みを入れて図示上方に突出させるようにしている。また、集電接続体2の接続板部2bは、図2(b)に示すように、この二等辺三角形形状の変形部4bが窪む図示下側の板片4aに溶接する。従って、この挟持板4は、両板片4a、4aの変形部4bが二等辺三角形形状の底辺で折れ曲がり、金属箔を一部切断しながら頂点側が上方に食い込むことにより、確実に強固な接続固定を行うことができる。しかも、このような変形部4bにより、金属箔が挟持板4から引き抜かれ難くなる。

## 【0024】

また、上記実施形態では、1枚の金属板を折り曲げて両板片4a、4aを対向させた挟持板4を使用する場合を示したが、両板片4a、4aの間に金属箔を挟み込んでかしめることができればよいので、これらの両板片4a、4aはそれぞれ独立した金属板であり、かしめによ

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って一体化されるものであってもよい。さらに、上記実施形態では、発電要素1の各端面にはみ出す金属箔を二方に分けて重ね合わせるることにより、2枚の挟持板4に挟み込む場合を示したが、使用する挟持板4の数は任意であり、これらの金属箔を一括して重ね合わせて1枚の挟持板4に挟み込んでよいし、3枚以上の挟持板4に挟み込むようにすることもできる。

## 【0025】

また、上記実施形態では、挟持板4の両板片4a、4aにほぼ半球状や二等辺三角形形状の変形部4bを設けてかしめる場合を示したが、この変形部4bの形状や切り込みの有無は任意であり、例えば板片4aの長手方向に筋状に長い凹凸を設けることもできる。さらに、このような変形部4bを設けることなく、挟持板4の両板片4a、4aを両側から強く押圧することにより金属箔をかしめることも可能である。ただし、この場合には、かしめを確実なものにするために、挟持板4の両板片4a、4aに予め凹凸を形成しておくことが好ましい。

## 【0026】

また、上記実施形態では、挟持板4に金属箔を挟み込んでかしめた後に接続板部2bとの溶接を行う場合を示したが、先に挟持板4と接続板部2bとを溶接しておき、この挟持板4に金属箔を挟み込んでかしめるようにすることもでき、この溶接とかしめを同時に行うことも可能である。さらに、上記実施形態では、挟持板4と接続板部2bとを超音波溶接により接続固定する場合を示したが、スポット溶接やレーザ溶接、TIG溶接等の他の溶接手段により接続固定を行うようにすることもできる。

## 【0027】

また、上記実施形態では、挟持板4の一方の板片4aの外面を集電接続体2の接続板部2bに沿わせて溶接を行う場合を示したが、他方の板片4aの内面に複数の突起を形成しておくと共に、この一方の板片4aの内面を集電接続体2の接続板部2bに沿わせて溶接を行うこともできる。即ち、金属箔を接続板部2bと共に挟持板4に挟み込んでかしめ、この接続板部2bを挟持板4に溶接により接続固定するようにしてもよい。このようにすれば、金属箔と挟持板4とが板片4aの突起により確実にかしめられると共に、この挟持板4と接続板部2bも確実に溶接されるだけでなく、金属箔と接続板部2bとが挟持板4のかしめにより密接して直接接続されるようになり、これらの接続部の電気抵抗を低減することができるようになる。

## 【0028】

上記の場合も、溶接とかしめはどちらを先に行ってもよいし、これらを同時に行うことも可能である。ただし、先に金属箔をかしめた状態で溶接を行うと、挟持板4と接続板部2bとの間だけでなく、この接続板部2bと金属箔との間にも溶接のエネルギーが加わり、従来のように金属箔が溶断して飛散するおそれもある。しかしな

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がら、金属箔の挟持板4や接続板部2bへの接続固定はあくまでかしめによって行われるものであり、特に板片4aの突起が金属箔に食い込んで確実にかしめられることになるので、溶接箇所を例えば間隔を開けた複数箇所に限定することにより、この溶接箇所での金属箔は溶断飛散により接続が不安定になることはあっても、溶接箇所以外ではかしめにより金属箔が確実に接続固定されるようにすることができる。この際、挟持板4は、板片4aの突起が形成された部分を避けて溶接箇所を設定することが好ましい。このようにすれば、金属箔は突起を形成した部分で確実にかしめにより接続固定されると共に、接続板部2bは突起を形成していない溶接箇所ですぐに溶接により接続固定されるようにすることができる。

## 【0029】

また、上記実施形態では、金属板からなる集電接続体2が本体2aから折れ曲がって櫛歯状に突出した接続板部2bに挟持板4を接続固定する場合を示したが、この集電接続体2の構成は任意であり、他の形状の金属板や単なる棒材又は金属材料を削り出したり鋳物により形成したものを等を用いることもできる。

## 【0030】

また、上記実施形態では、長円筒形巻回型の発電要素1について説明したが、この発電要素の構成は任意であり、円筒形巻回型の発電要素や積層型の発電要素にも同様に実施可能である。例えば円筒形巻回型の発電要素の場合には、比較的長さの短い挟持板を用いるか、円筒形にはみ出す金属箔に沿って湾曲した挟持板を用いるようにすればよい。さらに、上記実施形態では、非水電解質二次電池について説明したが、発電要素の電極の集電基材となる金属箔を集電接続体を介して端子に接続した電池であれば、この電池の種類は任意である。

## 【0031】

## 【発明の効果】

以上の説明から明らかなように、本発明の電池によれば、

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発電要素の電極の集電基材となる薄い金属箔が適度な板厚の金属板からなる挟持板を介して厚い集電接続体に容易かつ確実に接続固定されるようになるので、電池の組み立て工程での作業性を向上させると共に品質を安定させ、電池性能の向上を図ることができるようにする。

## 【図面の簡単な説明】

【図1】本発明の一実施形態を示すものであって、長円筒形の発電要素の片側の直線部における一方の端面部にはみ出した正極のアルミニウム箔に挟持板を介して集電接続体の接続板部を接続固定する工程を示す部分横断面図である。

【図2】本発明の一実施形態を示すものであって、長円筒形の発電要素の片側の直線部における一方の端面部にはみ出した正極のアルミニウム箔に挟持板を介して集電接続体の接続板部を接続固定する他の工程を示す部分横断面図である。

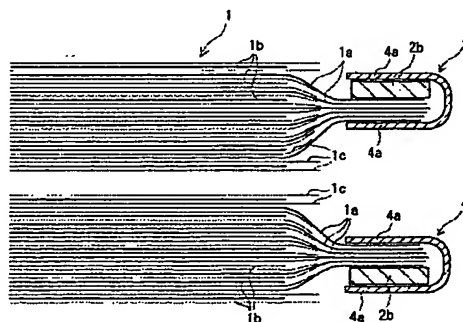
【図3】従来例を示すものであって、長円筒形巻回型の発電要素の電極に集電接続体を介して端子を接続する構造を示す斜視図である。

【図4】従来例を示すものであって、長円筒形の発電要素における一方の端面部にはみ出した正極のアルミニウム箔に挟持板で挟持して集電接続体の接続板部を接続固定した構成を示す部分横断面図である。

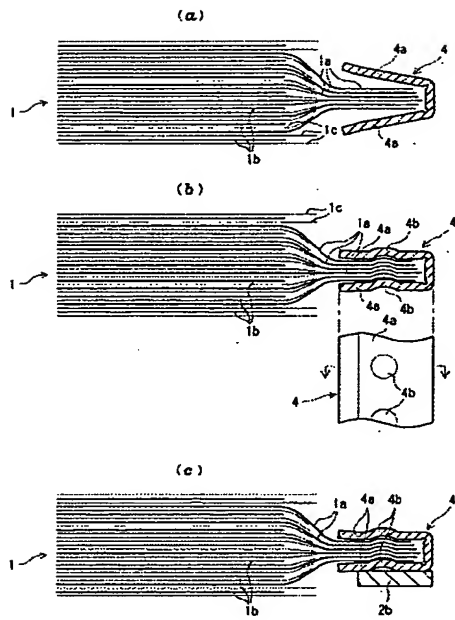
## 【符号の説明】

- 1 発電要素
- 1a 正極
- 1b 負極
- 2 集電接続体
- 2b 接続板部
- 3 端子
- 4 挟持板
- 4a 板片
- 4b 変形部

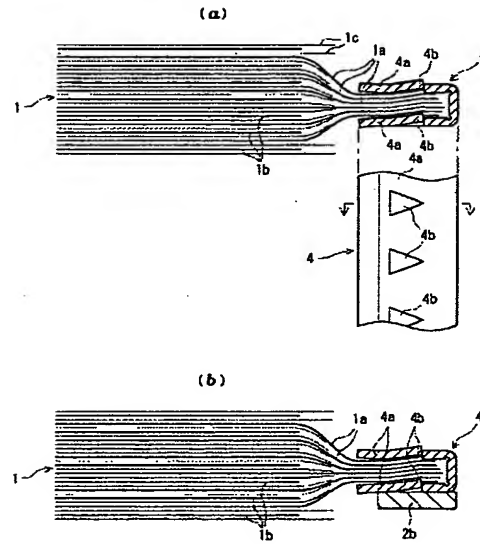
【図4】



【図1】



【図2】



【図3】

